April 8: "Geometric probabilities" by Dr. Florence Allen, instructor.
April 22: "Squaring the circle" by Professor W. W. Hart.
May 27: Election of officers; annual reports.
October 28: "The semi-regular solids of Archimedes" by Professor E. B. Van Vleck.
November 11: "Mathematics and logic" by Professor Dresden.
December 2: "Methods of mathematics" by Victor Von Szeliski.
December 16: "Wave motion" by Professor Schlichter.
January 13, 1921: "Expansion of fundamental laws of algebra" by Professor Skinner.
January 27: "The value of π" by Grace Desimval '21.
February 24: "Interesting applications of the theory of probability" by Professor Max Mason.

(Report by Miss Tucker.)

PROBLEMS AND SOLUTIONS.

EDITED BY B. F. FINKEL, OTTO DUNKEL, AND H. P. MANNING.

Send all communications about Problems and Solutions to B. F. FINKEL, Springfield, Mo.

PROBLEMS FOR SOLUTION.

[N.B. Problems containing results believed to be new, or extensions of old results are especially sought. The editorial work would be greatly facilitated if, on sending in problems, proposers would also enclose any solutions or information that will assist the editors in checking the statements. In general, problems in well-known text-books, or results found in readily accessible sources, will not be proposed as problems for solution in the MONTHLY. In so far as possible, however, the editors will be glad to assist members of the Association with their difficulties in the solution of such problems.]

2920. Proposed by N. P. PANDYA, Sojitra, India.

Construct a triangle, having given the base, the angle between the base and the median on it, and the difference of the remaining two sides.

2921. Proposed by J. W. CLAWSON, Ursinus College, Pa.

ABC is a triangle cut by a transversal PQR, so that A, P; B, Q; and C, R are opposite vertices of a complete quadrilateral. Draw CD, PF, QE, chords in the circles circumscribing, respectively, triangles ABC, BRP, AQR, all these chords being parallel to AB.

Prove that (i) D, E, F are collinear; (ii) the line DEF passes through the Wallace point of the quadrilateral (the point of concurrency of the circles mentioned above); (iii) the line DEF intersects AB at the point of tangency to AB of the parabola which touches the four sides of the quadrilateral.

2922. Proposed by the late A. M. KENYON.

A telephone engineer desires the general solution of the following differential equation:

$$x\frac{d^2y}{dx^2}+\frac{dy}{dx}=\frac{a}{\sqrt{y}}.$$

2923. Proposed by C. N. SCHMALL, New York City.

The corner of a page of a book is turned down in such a manner that the triangle formed has a constant area. Show that the locus of the corner is an oval of the curve,

$$r^2 = a^2 \sin 2\theta.$$

2924. Proposed by FLORENCE P. LEWIS, Goucher College.

Given a triangle and a conic. Through each vertex of the triangle there pass two lines harmonic to the tangents through that point and to the sides of the triangle. Prove that the six lines so found pass by threes through four points.

2925. Proposed by F. V. MORLEY, New College, Oxford, Eng.

A regular polygon of $2n+1$ sides will have only $n-1$ diagonals of different lengths (*e.g.*, the regular heptagon has two distinct diagonals). Call the side of such a polygon a_1, and the $n-1$ diagonals in order of size $a_2 \cdots a_n$. Then if the circumscribed circle has radius unity, $\sum_{i=1}^{n} a_i^2 = 2n+1$; in words, the sum of the squares of the distinct lengths obtained by joining an odd number of regularly spaced points on a unit circle is equal to the number of such points.

2926. Proposed by T. M. SIMPSON, Randolph-Macon College, Ashland, Va.

Solve the differential equation,

$$(y + x^2)dx + (x - x^2y)dy = 0.$$

2927. Proposed by PHILIP FRANKLIN, Princeton University.

Prove that the only positive integral values greater than unity which satisfy the equation $3^x - 2^y = \pm 1$ are $x = 2$, $y = 3$. (Cf. Carmichael, *Diophantine Analysis*, 1915, p. 116, exercise 69.)

NOTES.

22. Huge Numbers.—"What is the largest number that we can express by three digits?" The answer is $N = 9^{(9^9)}$, that is $9^{387,420,489}$. C. A. Laisant drew attention to this number in his *Initiation Mathématique*, Paris, 1906 (English edition, London, 1913). He there remarks that in decimal numeration this number would have 369,693,100 figures. To write it on a single strip of paper, supposing that each figure occupied a space of one fifth of an inch, the length of the strip would need to be 1,166 miles, 1,690 yards, 1 foot, 8 inches. In this connection C. E. Guillaume remarked (*Revue Générale des Sciences*, vol. 17, 1906, p. 878) that under the same conditions to write $10^{(10^{10})}$, we would need a strip of paper long enough to encircle the earth.

Writing in May, 1913, A. C. D. Crommelin stated (*Journal of the British Astronomical Association*, vol. 23, pp. 380–381) that he had come across the problem with which this note commences "in an old logarithm book." By the aid of 61-figure logarithms of certain numbers given in Hutton's tables Dr. Crommelin found $\log N = 369{,}693{,}099.6315703587\cdots$; whence the number of figures indicated above. He found the first 28 of the figures to be 428,124,773,175,747,048,036,987,115,9 and the last three to be 289.

"A knowledge of 30 figures out of 300 million," he continued, "may seem trifling, but in reality the error involved in taking all the remaining figures as zeros is only one part in a thousand quadrillions. If the number were printed with 16 figures to an inch (about the tightest packing for decent legibility), it would extend over 364.7 miles. . . . If printed in a series of large volumes we might get 14,000 figures to a page, and with 800 pages to the volume it would fill 33 volumes. There are more than twice as many digits in the number as there are letters in the whole of the *Encyclopædia Britannica*.

"To find the largest number suggested by sideral astronomy I took the following. Both Very and See have expressed the opinion that certain visible objects may be at a distance of a million light years; I imagine a solid sphere of platinum of this radius, and find how many electrons it contains. From Duncan's *The New Knowledge*, p. 65, I find that the log of the number of electrons in a cubic centimetre of water is 16.469. Taking the density of platinum as 21.5 the log of the number of electrons in a cubic inch of it is 19.016, and the log of the volume of the